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An in vitro study of apical extrusion of sodium hypochlorite during endodontic canal preparation

Brown DC, Moore BK, Brown, JR. CE, Newton CW. An in vitro study of apical extrusion of sodium hypochlorite during endodontic canal preparation. J Endodon 1995;21:587-91.

PURPOSE: To assess the volume of NaOCl that is extruded apically during RCT and to determine if there is a technique available to reduce NaOCl extrusion.

M&M: 153 single-canaled teeth were divided into 4 groups, 2 experimental and 2 control. Each tooth was assessed according to tooth length, width, root curvature in M-D and B-L planes, and the area of the apical foramen. Teeth were accessed, positioned in the openings of small glass specimen bottles, and instrumented using a balanced force technique. Group 1 teeth (50) were irrigated with 2.5% NaOCl delivered deep within the canal, and group 2 teeth (51) with 2.5% NaOCl placed only in the access cavity. The two control groups were treated the same, substituting distilled water for NaOCl. Volume of irrigation solution extruded apically was measured by calculating the concentration of sodium present in the extruded debris.

RESULTS: Statistical analysis showed that significantly less NaOCl had been extruded apically during cleaning and shaping with reservoir delivery of the irrigant as compared with deep delivery.

C&C: Apical extrusion of NaOCl may not only result from deep delivery of the irrigant but also as a result of the filing action of the endodontic instrument acting as a piston, forcing the solution through the apex. While reservoir delivery of NaOCl may help prevent extrusion of NaOCl through the apex and subsequent hypochlorite accidents, the necrotic tissue-debriding action of the NaOCl is probably reduced. Thus there are trade-offs. Due to the low number of incidents involving NaOCl extrusion, canal delivery without binding and with gentle expression of the solution remains justified.

**December 1995
Hall**

Michael

Clinical evaluation of the efficacy of EDTA solution as an endodontic irrigant

Yoshida T, Shibata T, Shinohara T, Gomyo S, Sekine I. Clinical evaluation of the efficacy of EDTA solution as an endodontic irrigant. J Endodon 1995;21:592-3.

PURPOSE: To examine the relation between removal of the canal wall smear layer and the presence of microorganisms, as detected by canal culturing.

M&M: 189 single-canaled teeth from 126 patients had been diagnosed as having pulp necrosis or chronic apical suppurative periodontitis. Following access preparation and initial instrumentation (#25), the dentin shavings were placed into culture medium. Each tooth was enlarged up to a #70-80 file, with alternative irrigation using 5% NaOCl and 3% H₂O₂. After completed preparation, 129 teeth were irrigated with 15% EDTA, and 60 were irrigated with saline. Ultrasonic activation (ENAC-6) was applied to each root canal with irrigant in place for 1 min. Another sample was then taken after the canals were dried. The teeth were sealed. Final intracanal samples were obtained at the 2nd visit after 1 wk. Culture tubes were incubated under anaerobic conditions.

RESULTS: All of the 1st samples were positive for bacterial growth. In the 2nd samples (following cleaning and shaping), 81% of the EDTA group and 75% of the saline group gave negative cultures after 48h incubation (not significantly different). In the 3rd samples (1 wk later), 72% of the EDTA group and 35% of the saline group produced no bacterial growth. The group using saline showed a significantly lower percentage of negative cultures than did the EDTA group. The drop in negative cultures was significant for the saline, but not for the EDTA.

C&C: The authors conclude that 15% EDTA is more effective at bacterial control than is saline solution, as a root canal irrigant. Its success at sterilizing root canals, they suggest, lies in its ability to remove smear layer (Yamada et al., 1983). Microorganisms are mixed with the smear layer, and protected by it while they lay low in dentinal tubules. Thus, the negative cultures obtained when the smear layer was retained were not indicative of a sterile canal; the sampling method could not reveal microorganisms deeper than the outer surface of the smear.

**December 1995
Bates**

Christopher F.

Scanning electron microscopic evaluation of two compaction techniques using a composite resin as a root canal filling material

Anic I, Shirasuka T, Matsumoto K. Scanning electron microscopic evaluation of two compaction techniques using a composite resin as a root canal filling material. J Endodon 1995;21:594-7.

PURPOSE: To compare the effectiveness of vertical and lateral techniques for introduction and compaction of composite resin as a root canal filling material.

M&M: 20 single-rooted teeth were used. The crowns were removed at the CEJ or lower so that each root was 20 mm. The canals were instrumented and divided into 2 groups of 10 each. The argon laser HGM was used, with a 488 nm wavelength beam delivered through a quartz fiber 300 μ diameter. In group A, the smear layer was removed and composite resin was incrementally compacted with lateral condensation motions and photopolymerized with the laser. In group B, each layer of composite was vertically compacted only. Samples were prepared for SEM examination, and some were demineralized to form resin replicas, which were then examined.

RESULTS: SEM revealed that smear layer removal allowed resin penetration of tubules. Large voids within the fillings as well as along the periphery were seen in group B teeth. Fewer voids were seen in group A teeth.

C&C: The lateral compaction technique used in group A teeth resulted in more complete obturation than the purely vertical technique used in group B teeth. Contraction of composite resin seemed to occur following photopolymerization with the laser in both groups, however, leaving voids between dentin and bonding agent, and bonding agent and resin. An expensive obturation technique.

**December 1995
Hall**

Michael

Cross-sectional configuration of endodontic files compared with manufacturers' design

D'Souza JE, Walton RE, Maixner D. Cross-sectional configuration of endodontic files compared with manufacturers' design. J Endodon 1995;21:599-602.

PURPOSE: To compare the actual cross-sectional configuration of files with diagrams of "ideal" configurations provided by the manufacturers. Specifically determined were uniformity of shape and presence of a cutting edge.

M&M: 7 brands were evaluated: ground-twisted - K-file (Brassler), K-reamer (Brassler), and K-flex (Kerr); machined - Flex-R (Union Broach), Burns Unifile (Quality Dental Products), S-file (Sjoding), and Hedstrom (Kerr/Sybron). 12 files of sizes #10, #25, and #40 (each size and brand) were embedded in acrylic, and transversely cut at the apical (2-3 mm from the tip) and coronal (2-3 mm into the flutes) parts of each file. 6 clinicians blindly assessed the photomicrographs of each file, by scoring the shapes and presence of cutting edges.

RESULTS: **Shape** - #25 and #40 files conformed with manufacturers' designs more consistently than #10 files. Agreement was more consistent in coronal than in apical sections; **cutting edges** - well-defined cutting edges were present at both ends of the #25 and #40 files. Discerning defined cutting edges was difficult at the apical sections of the #10 files (particularly Hedstroms and S-files); and **manufacturing process** - ground-twisted files were more consistent than the machined files, with regard to ideal cross-section and presence of cutting edges. Within the machined group, the Flex-R and S-file were superior to Hedstrom and Unifile (many small Unifiles had no apical flutes at all).

C&C: The inconsistencies were found primarily in machined files, smaller sizes, and apical sections of the instruments. The best quality was observed in larger sizes, in coronal regions of the files, and in the ground-twisted instruments. Physical mass and/or diameter is an important production factor; ie, variability in the apical end and in the smaller files must result because of difficulties in precision control during manufacturing. Overall however, the authors applaud the good comparison between the manufacturers' designs and actual products.

**December 1995
Bates**

Christopher F.

Investigation of mineral trioxide aggregate for root-end filling in dogs

Torabinejad M, Hong C-U, Lee S-J, Monsef M, Pitt Ford TR. Investigation of mineral trioxide aggregate for root-end filling in dogs. J Endodon 1995;21:603-8.

PURPOSE: To investigate the response of periradicular tissues of dogs to amalgam and MTA when used as root-end filling materials.

M&M: Right and left max 3rd and 4th premolars of 6 beagle dogs were used. Root canals were exposed, debrided and left open to the oral environment for 2 wks and then closed with Cavit for 4 wks. After contamination the teeth were divided into 2 groups of 12 teeth. In group 1 the canals were obturated with GP and sealer and the access openings closed with MTA; in group 2 no sealer was used and the access openings left open. Periradicular surgeries were performed 1 to 2 wks after RCT; amalgam root-end fillings were used on the 3rd and 4th premolars on one side of the mandible, while MTA was used on the other side. Three dogs were killed 2 to 5 wks after surgery, and 3 were killed 10 to 18 wks after surgery. Block sections were prepared for histological study.

RESULTS: Statistical analysis of the results showed that there was less periradicular inflammation and more fibrous capsule formation around the root ends filled with MTA; also, the presence of cementum was seen on the surface of some of the MTA-filled root ends, while none was seen on amalgam.

C&C: This study, plus the results of prior MTA studies, shows that MTA is a biologically suitable root-end filling material.

**December 1995
Hall**

Michael

Effect of nickel-titanium engine-driven instrument rotational speed on root canal morphology

Poulsen WB, Dove SB, del Rio CE. Effect of nickel-titanium engine-driven instrument rotational speed on root canal morphology. J Endodon 1995;21:609-12.

PURPOSE: To compare canal preparations produced by Ni-Ti engine-driven Lightspeed instruments when rotated at 3 different speeds.

M&M: 18 extracted, mandibular molars were endodontically accessed, and the distal roots were removed. Canal lengths and curvatures in the 36 mesial canals were determined. Specimens were embedded in clear casting resin, stone locking fixtures were fabricated (Bramante technique), and mesial canals were sectioned perpendicular to the root surface in the midroot and apical regions. The canals were randomly divided into 3 experimental groups of 12, according to canal anatomy. All canals were instrumented by an Aseptico electric handpiece/Lightspeed system at a constant speed of 750, 1300, or 2000 rpm. Computer imaging was done on each root section before instrumentation, and after instrumentation to size #30, #45, and step-back to #60 (0.5 mm/half-size increments). Image analysis allowed determination of canal shape, area of dentin removed, length of transportation, and centering ratio.

RESULTS: The 3 rotational speed groups were initially similar. At size #30, 1 canal was round, and none were oval. At size #45, 25% of the canals in the midroot sections and 50% in the apical sections were either round or oval. After step-back to size #60, 88% of the canals in the midroot region and 92% of those in the apical section were either round or oval. There was no significant difference among the 3 groups in the amount of dentin removed, canal transportation, or the instruments' ability to remain centered. No instrument fractures occurred.

C&C: The Lightspeed system appears to be safe and equally effective when used at constant speeds ranging from 750 to 2000 rpm (as recommended by the manufacturer). The authors reported some loss of tactile sensitivity and difficulty with curvature negotiation at 2000 rpm, which was not observed at 750 or 1300 rpm. It was not until step-back instrumentation occurred that a high percentage of canals became round or oval (indicative of planing by instruments).

**December 1995
Bates**

Christopher F.

Anaerobic tissue-dissolving abilities of calcium hydroxide and sodium hypochlorite

Yang S-F, Rivera EM, Baumgardner KR, Walton RE, Stanford C. Anaerobic tissue-dissolving abilities of calcium hydroxide and sodium hypochlorite. J Endodon 1995;21:613-6.

PURPOSE: To evaluate and compare tissue-dissolving properties of CH and NaOCl on bovine pulp tissue under aerobic and anaerobic conditions.

M&M: 60 bovine pulp specimens were used and divided into 6 experimental and control groups. Dry weights of each specimen were obtained. Specimens were placed in microfuge tubes with CH, 2.5% NaOCl, or water solutions, and incubated in aerobic or anaerobic conditions for 7 days. Tissue specimens were then dried again to obtain final dry weights. Amount of bovine pulp tissue dissolved was determined by specimen weight loss.

RESULTS: The data showed no significant differences in percentage weight loss under aerobic vs. anaerobic conditions for either the CH or NaOCl experimental groups or the water control groups. CH and NaOCl groups showed more weight loss than water under both conditions, but there was no significant difference between the CH and NaOCl groups.

C&C: The dissolving action of CH and NaOCl was found to be unaffected by the oxygen environment in this study. NaOCl was found to affect tissue markedly the first 1 to 2 h, while CH did not decrease tissue volume initially but acted gradually over 7 days. These differences point out the different tissue-dissolving mechanisms of CH and NaOCl.

**December 1995
Hall**

Michael

A microbiological and immunological study of endodontic-periodontic lesions

Kurihara H, Kobayashi Y, Francisco I, Isoshima O, Nagai A, Murayama Y.
A microbiological and immunological study of endodontic-periodontic lesions. J Endodon 1995;21:617-21.

PURPOSE: To investigate the microbiological and immunological aspects of endo-perio lesions in order to gain further understanding of the involved host-parasite interactions.

M&M: 5 patients, each having 1 tooth with the following criteria were studied: it was (1) caries-free; (2) nonresponsive to EPT; (3) had no history of trauma; and (4) exhibited a combined periodontic-endodontic lesion, determined both radiographically and clinically. The contents of the root canal system, deepest periodontal pocket, and exudate from the periapical tissues were anaerobically cultured. Phase contrast microscopy was used for morphological classification and identification of isolated microorganisms. IgG titers for 15 microorganisms were determined in the apical tissue exudate, periodontal pocket exudate, and peripheral blood serum by an ELISA.

RESULTS: The microbial population was found to differ morphologically between the root canals and periodontal pockets. In every root canal, cocci and rods were abundant, whereas spirochetes were not seen. In every periodontal pocket, spirochetes, rods, and motile rods were more predominant than cocci. The root canals harbored only a few bacterial species, whereas the periodontal pockets contained a large variety of species. In 2 patients, the predominant species from the root canals were not detected in the corresponding periodontal pockets. In the other 3 however, the predominant species in the root canals were detected at low levels in the corresponding pockets. IgG antibody titers to specific microorganisms varied greatly among patients. Overall, no correlation was found between microbial isolates and antibody titer in the apical tissues or periodontal pockets.

C&C: The microbiological composition in the root canals was found to be small in number of microorganisms and limited to a few species, with no spirochetes noted. Additionally, dominant microbes in the adjacent periodontal pocket were not always found to be dominant in the root canals. The authors believe these results support the suggestion that the source of endodontic infection in endodontic-periodontic lesions of primary periodontal etiology is the periodontal pocket.

December 1995
Bates

Christopher F.

Comparative tissue toxicity evaluation of four endodontic sealers

Mittal M, Chandra S, Chandra S. Comparative tissue toxicity evaluation of four endodontic sealers. J Endodon 1995;21:622-4.

PURPOSE: To evaluate the response of rat subcutaneous tissue to 4 root canal sealers.

M&M: 15 adult albino rats were used. Four sealers were tested: ZOE, Tubli seal, Sealapex, Endoflas F.S. Normal saline was used as a control. The sealers were mixed thin and injected subcutaneously with 0.1 ml of sealer or saline. Three animals were killed at 48 h, 7 days, 14 days, 1 mo, and 3 mos. All tissue was excised, fixed, and prepared for histological study.

RESULTS: At 48 h, severe inflammation was seen with ZOE, Tubli seal, and Endoflas; moderate and mild reactions were seen with Sealapex and saline, respectively. After 7 days, severe inflammation persisted with ZOE, Tubli seal, and Endoflas; only a mild reaction was seen with Sealapex. After 14 days, reactions were moderate with all sealers but Sealapex, which was mild. After 1 month, moderate inflammation persisted with Tubli seal and Endoflas; mild inflammation could be seen with ZOE and Sealapex. At 3 months, no inflammation could be seen with any sealers.

C&C: Nothing new here -- all immediate and short-term responses were as would be expected to solutions containing free eugenol (ZOE, Tubli seal, and Endoflas F.S.), while the non-eugenol containing Sealapex would not be expected to elicit as strong a response. Endoflas F.S. also contains PCP, which accounts for the stronger inflammatory response it generated.

**December 1995
Hall**

Michael

Central odontogenic fibroma mimicking a lesion of endodontic origin

Huey MW, Bramwell JD, Hutter JW, Kratochvil FJ. Central odontogenic fibroma mimicking a lesion of endodontic origin. J Endodon 1995;21:625-7.

REVIEW: Occasionally, a radiographic periradicular lesion is present, yet the associated tooth responds normally to clinical vitality tests. This lesion, therefore, is unlikely to be caused by pulpal necrosis. The central odontogenic fibroma (COF) is one such (uncommon) mimicker of lesions of endodontic origin. Clinically, the COF can present as an asymptomatic expansion of the buccal or lingual cortical plate, or a depression of the gingiva overlying a cortical perforation. The lesion occurs in the maxilla and mandible with equal frequency. Radiographically, it has been described as either a radiolucent lesion, or one of mixed radiodensity. Root resorption and divergence of the roots have been observed. 56 cases have been reported in the dental literature.

CASE REPORT: A 42-yr-old man estimated that a gingival cleft of his right palate had appeared 3 yrs previously, and that the diastema present between the maxillary right canine and lateral incisor was getting larger. All teeth in the area responded positively to the electric pulp tester and thermal testing. A traceable sinus tract radiographically pointed to a "1 cm × 1 cm" [appears considerably larger than this on the radiographs], multilocular, radiolucent lesion of the right anterior maxilla. Flaring and resorption of the roots of teeth #7 and 8 were evident. The initial differential diagnosis included COF, radicular cyst, or odontogenic myxoma. Treatment included nonsurgical RCT on teeth #6,7 and 8, followed by a palatal approach, excisional biopsy. Surgical RCT was believed indicated; however, access limitations precluded root-end procedures until 2 wks later, when root-end resection, preparation, and Super-EBA fillings were performed on #7 and 8. The specimen histopathological diagnosis was COF.

C&C: The authors correctly advise that as endodontists, we must not become complacent in the diagnosis of periapical pathoses, but be cognizant of other etiologies. The presented central odontogenic fibroma is one such example. It is possible that the case presented could have represented any number of entities, some potentially persistent (ameloblastoma), vascular (central hemangioma), or rarely malignant (metastatic carcinoma). Thus, once it had become clear that this lesion was some non-endodontic pathosis, it would have been very appropriate to team-treat this patient with an oral surgeon.

December 1995 Christopher F. Bates